How important are land prices to promote smart mobility?

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This paper researches and proposes an objective way to compute land prices, based on their real and current values, and not on speculative grounds.
This general concern falls within the framework of the overall revision of the Portuguese Land Use Law currently taking place, that pursues the following goals: to assure citizens´ access to housing (preventing real estate speculation); to control urban development processes, and to recover a significant slice of vacant dwellings; to ensure an increased transparency in urban processes, and a deeper involvement of citizens; and to return the surplus-values accrued from public interventions for the benefit of the society in general.
The methodology proposed in this research founds on the Real Estate Municipal Tax Code - that was applied to the Municipality of Bragança - in order to determine the average price of land/m^2 according to the location and uses anticipated by the Municipal Master Plan (within the categories of developed land and land which development may be programmed, both aimed at built-up spaces). The comparison between the values attained and the homologous market values show up that the former are substantially lower than the latter. So the enforcement of the new Land Use Law – that tentatively includes the application of the current methodology, together with other proposals - stresses the importance of this law-supported objective way to assess land prices. It straight reflects into the anticipated costs of urban development, construction initiatives, and transport infrastructures, and into the costs involved in the implementation of accessibility and mobility measures. It consequently, exerts an important impact on the promotion of smart mobility for the municipality´s population.

Keywords: Land Prices; Land Use Law; Real Estate Municipal Tax Code; Tributary Patrimonial Value; Surplus-values; Speculation

1 Introduction

The study of land price formation, the setting up of its underlying parameters and the development of devices aimed at controlling those prices are relevant within the framework of planning policies and tools that foster mobility goals. In this research mobility is understood as the ability to provide people with conditions to access swiftly and efficiently their destinations.

In the field of the revision of the Land Use Law, currently under way, the awareness of land price formation, as well as a clear, impartial and objective assessment based on their real and current values, and its systematization according to location and uses, will invest municipal powers with an appropriate control over land prices. This may be set up, thereafter (from both urban planning and urban management views) as an incentive to enhance urban development, to implement urban transport infrastructures, and to promote a smart urban mobility as it: ensures fair dwelling prices

(thus preventing land and real estate speculation); controls urban sprawl processes and recovers most of vacant dwellings; supports endeavours to fight speculation, assuring higher transparency and citizens´ participation in development processes; and assures that surplus-values engendered by public planning decisions are allocated for the social interest in general.

The research reported in this article first computes the price/m^2 of land for urban development from statistical data on market transactions that took place in the Municipality of Bragança. Real prices/m^2 of the underlying land are, then, computed according to the Real Estate Municipal Tax Code. The results attained from these distinct methodologies are, thereafter, compared, and some conclusions are drawn in order to pinpoint the need to monitor and control land values from a legal price-reference framework. As far as the Municipality of Bragança is concerned, this knowledge supports possible municipal interventions targeted to increase mobility and accessibility, and to promote the general well-being of its population.

2 Theoretical framework

Land prices depend both on their natural/geomorphological features, on the one hand, and on its economic functions, on the other (Pardal, 2006). These functions – that reflect the rights underlying land ownership as consumption goods – depend more and more on territorial plans, and less and less on the income engendered by land as a productive factor.

The formation of land prices is strictly connected to its territorial structure, as well as to the land use policy – that rule the juridical, economic, administrative and functional appropriation of land, and disciplines inter-territorial and neighbourhood relations - pursued by central and local authorities (Pardal, 2006). To sum up: the plans, the land use policy,and the dynamic characteristics of the economy exert a significant influence on land values (Pardal, 2006).

In order to point out the contributions of public and private interventions on land values, a certain land plot may be split and analysed in two distinct components (Pardal, 2004): its territorial-based value, that depends on its juridical status, dimension, location, use and use intensity entitled by applicable territorial plans; and its remaining value, that accrues from landowner´s improvements (Lee, 2003; Arnott and Petrova, 2006; Pardal, 2004, 2006). As the territorial-based value depends on social and territorial dynamics and on planning interventions outside the landowner´s purposes (namely territorial plans and other land use tools), its value represents the price that should reasonably be supported by the socio-economic activities developed in a certain land plot (Lee, 2003; Pardal, 2004, 2006). The remaining value refers to the components that intervene in the formation of the land patrimonial or market value - that strictly depend on the landowners´ merit and investment -, and is also shaped by market features (Arnott and Petrova, 2006; Lee, 2003; Pardal, 2004, 2006).

3 Methodology

The methodology pursued in this article follows four inter-related steps:

- Computation of the annual average cost per m^2 with urban infrastructures´ execution, maintenance and reinforcement;
- Computation of land prices/m^2 based on urban property´s market transactions;

- Computation of land prices/m^2 based on the application of the Real Estate Municipal Tax Code;
- Comparison and discussion of the attained results, and conclusions.

In order to prevent fluctuations depending on the situation, these values were computed as the annual average of four years (the latest four years provided with available data from the Portuguese National Statistics Institute and from municipal sources).

3.1 Computation of the annual average cost /m^2 with urban infrastructures´ execution, maintenance and reinforcement

For each year under analysis, the amount of budgeted investments was collected for the following urban infrastructures: streets and road network; drainage systems of domestic, industrial and pluvial residual waters (namely collector networks and wastewater treatment plants); public lighting; public parking (including surface parks, underground parks and multimodal transport terminals); neighbourhood equipment and public spaces. Investments in sewerage and water supply have been considered in all despite only the investments in urban qualification strictly connected to streets were taken into consideration. As far as investments in environment protection and green spaces are concerned, only those reflecting neighbourhood green spaces were contemplated. It is also important to stress that in the reckoning process was used the whole value for the anticipated investments (and not just the part assigned to pre-defined investments), so that to assure that all municipal investment are covered without financing requirements.

The annual cost/m^2 with infrastructures´ execution, maintenance and reinforcement was computed, then, by the quotient between the municipal investment in the previously identified items in 2009, 2010, 2011 and 2012, and the corresponding annual gross built surface.

To compute the latter, data concerning the total number of finished buildings[1] (new construction, and buildings´ enlargement, changes or reconstruction) was collected from statistical regional yearbooks (INE, 2009, 2010, 2011, 2012). The total liveable surface for urban uses (m^2) was, then, estimated by the product between this number and the average liveable surface per housing building. The latter, by its turn, was reckoned through the product among the average number of floors per building, the average number of dwellings per floor, the average number of compartments per dwelling, and the average liveable surface per room (expressed in m^2). The total gross built surface is, thus, approached by the division of the total average liveable surface by 0,65 considering that the liveable surface usually amounts to approximately 65% of the gross surface.

The annual average infrastructures´ costs/m^2 is finally computed as the average of the previous costs/m^2 for 2009, 2010, 2011 and 2012.

3.2 Computation of land prices/m^2 based on urban property´s market transactions

This step began by the collection from the Statistical Regional Yearbooks (INE, 2009, 2010, 2011, 2012) of the total amount of urban properties traded in the market (expressed in euros). Their corresponding transaction value per m^2 of gross built surface was computed, for each year under analysis, through the quotient between the value of urban properties and the total gross built surface (expressed in m^2) previously computed. Following on, the construction costs/m^2 settled by

governmental decrees to apply the 39th article of the Real Estate Municipal Tax Code stated to be in force for 2008, 2009, 2010 and 2011 (Diário da República, 2008, 2009, 2010a, 2011), were subtracted to each of these annual transaction values/m^2, thus pointing out, for each year, the difference between the transaction value and construction costs per m^2.

In order to approach the transaction land price/m^2, the next step consisted in the survey of the correspondence between the built gross surface and the underlying land surface. The share of the difference between the transaction value and the building cots per square meter assigned to each specific type of area aimed at development uses (within the developed land and the land intended for development) was computed according to the following methodology. The built surface area licensed by the Municipal Master Plan per m^2 of land was first reckoned from the product between the maximum occupation index (in percentage) and the maximum use index (expressed in m^2 of gross built surface per m^2 of underlying land) for each type of developed space. The difference between the transaction value and the cost of construction by m^2 of land is thus given, for each type of space referred to, by the product between the licensed built gross surface per each square meter of land and these difference´s land value/m^2 for the respective year. The product between this later value and the percentage of land allocated to each use in relation to the whole land assigned to development spaces (presuming the weight of each type of surface in the final value of land/m^2 is proportional to respective surface) is, then, add up to all types of land assigned to development spaces. Thus this gives the value, for each year, of land/m^2 based on market transactions. The average annual value for the term of four years is subsequently computed, considering that the monetary value remained steady throughout (what is, else, confirmed by the trend of building costs/m^2 to remain unchanged (Diário da República, 2008, 2009, 2010a, 2011)). Infrastructure costs/m^2 (previously computed) are, then, subtracted to the latter value.

3.3 Computation of land prices/m^2 based on the application of the Real Estate Municipal Tax Code

The computation of land prices/m^2 based on the application of the Real Estate Municipal Tax Code enables a more unbiased and objective analysis of land values, as it founds on legislation currently in force. Besides setting benchmarks on these values, their comparison with the corresponding values that accrue from the market trade enables the screening for possible speculative margins. If municipalities are vested with the power to control these margins, the subsequent development and construction costs, in general, and costs involved in mobility planning, implementation and management, in particular, become lower, and more grounded on realistic actual data.

The minimum and maximum tributary patrimonial values per square meter of gross built surface licensed by the regulation of the applicable Municipal Master Plan were computed by the application of the formula settled in article 38th (Determination of the tributary patrimonial value) of the Real Estate Municipal Tax Code. These values are given by the product among buildings´ base values, and surface adjustment, allotment (minimum and maximum), location (minimum and maximum), quality and comfort (minimum and maximum), and ancientness coefficients (former and recent works), respectively.

These values reflect land and buildings´ joint values, so it is required to subtract them building and infrastructure costs in order to get values exclusively dependent on land. Construction costs/m^2

refer to those established by the governmental decree nº 307/2011, of the 21st December, applicable in 2012 cost estimates. The infrastructures costs/m^2 refer to the already computed average costs with infrastructures execution, maintenance and reinforcement. The municipal land value/m^2 is, thus, given by the difference between the average tributary patrimonial value/m^2 (computed from the previous minimum and maximum values) and the infrastructure costs/m^2 and building costs/m^2.

4 Case study: the Municipality of Bragança

4.1 Brief characterization of the Municipality of Bragança

The Municipality of Bragança is located in the Portuguese northeast extreme, in its northern region, in Alto Trás-os-Montes sub-region. It covers a surface of 1 173.9 Km^2 (14.4% of the Alto Trás-os-Montes sub-region surface, and 5.5% of the northern region surface) and lodges 35 341 inhabitants (INE, 2011). This Municipality is bordered at north and east by the Spanish regions of Ourense and Zamora, at southeast by the Municipality of Vimioso, at southwest by the Municipality of Macedo de Cavaleiros and at west by the Municipality of Vinhais (wikipedia; Nemus, 2009; Plural, 2009). It is one of the Portuguese biggest administrative districts, and is made of forty-nine parishes.

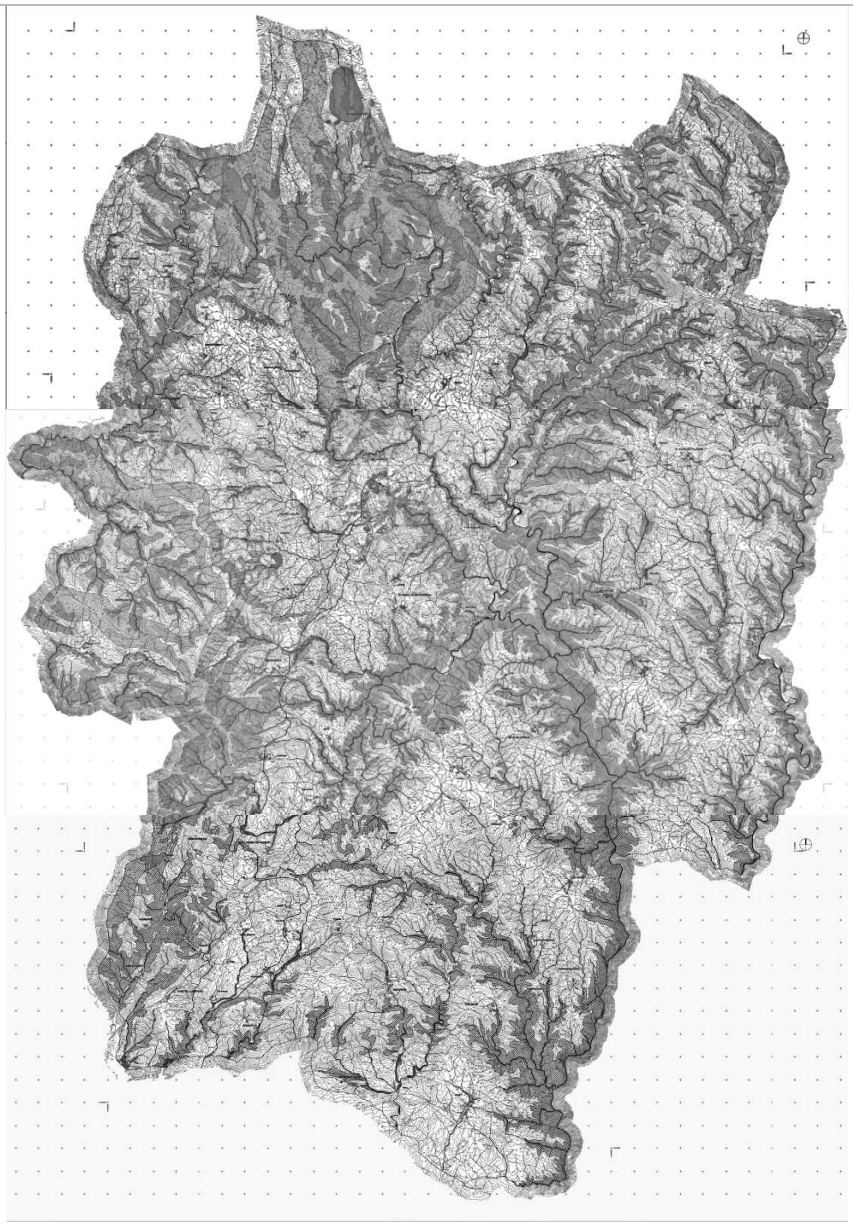

Figure 1. Municipality of Bragança (Source: Diário da República, 2010b)

The Municipal Master Plan (Diário da República, 2010c) is an instrument of territorial planning that, based on the municipal strategy for local development, settles the spatial structure, land classification and qualifications, as well as the parameters for land occupation and the requirements of urban facilities (Câmara Municipal de Bragança, 2010b).

According to its 2nd article – Goals and strategy -, the goals pursued by this Municipal Master Plan consist in: (i) the promotion of a municipal balanced development considering its territorial diversity, and the evolution that took place during the latter years; (ii) its articulation with the applicable higher-order territorial management tools[2]; (iii) its easy application and management, as well as its

connection with other enforced plans; (iv) its adjustment to the specific features of the Municipality, correcting abnormal situations, and fitting enforced legislation; (v) framing urban uses in rural spaces, respecting growth perspectives, favouring the filling in the interstitial spaces; (vi) standing up for the built heritage in general, and the historic and cultural heritage in particular; (vii) betting on forest diversification, regulating their possible uses, as well as the urban occupation of rural and isolated areas; (viii) maintaining the environment and the landscape; (ix) establishing a normative framework for municipal investments, specifying public municipal and state investments, and (x) restructuring the road network, linking it up with the road and train plans within the proposed ordinance interventions.

The strategy outlined by this Municipality to achieve these settled goals consubstantiates through: (i) the projection of an innovative image of the city, centred around the ecocity concept, strengthening their potentialities as a regional pole, an international link, and a trade and services centre; (ii) to reinforce the competitiveness and attractiveness of rural areas on population, through the provision of facilities, infrastructures and equipment, and through the requalification of their public spaces; and (iii) to enhance the natural, cultural and landscape heritage, and to boost the economic appreciation of endogenous potentialities.

As far as land occupation, use and use changes are concerned, and as explained in the chapter III of the Municipal Master Plan, the municipal land can be classified into rural and urban land. The latter is recognized potentialities to undergo development and building processes, and it includes within the urban perimeter developed land or land which development may be programmed, and well as land allotted to the urban environmental structure. According to the section I of the 4th chapter – Qualification of urban land -, the category of developed land includes developed spaces of types I, II, II, IV, V and VI, spaces for urban equipment, and industrial spaces. The category of land which development can be programmed includes, by its turn, the subcategories of developing spaces of types I, II, III, IV and V, spaces for urban equipment, and industrial spaces.

The developed spaces of types I, II, III, IV, V and VI within the category of developed land can be described by their high infrastructure levels and building concentration, being this land mainly assigned to construction (article 42nd). These spaces locate in central areas and other rather homogeneous places, characterized by high building concentration where housing, trade and services functions are prevalent, and they may even contain interstitial spaces. The designations assigned to these spaces correspond to their location within different built-up urban areas, and the applicable building indexes are systematized in Table 1:

Table 1. Building regime in developed spaces by space typology (Source: Diário da República, 2010c)

Space typologies	Built-up urban areas	Maximum occupation index (%)	Maximum use index (m^2 of built surface/m^2 of land)
Developed spaces of Type I	Bragança	60	4
Developed spaces of Type II	Bragança	-	-
Developed spaces of Type III	Izeda	40	0,8
Developed spaces of Type IV	Babe, Baçal, Coelhoso, França, Gimonde, Grijó de Parada, Nogueira/Couto, Outeiro, Parada, Paredes (Parada), Pinela, Quintanilha, Rabal, Rebordãos; Salsas, Santa Comba de Rossas, São Pedro de Sarracenos e Serapicos	40	0,6
Developed spaces of Type V	Alfaião, Aveleda, Calvelhe, Carragosa, Carrazedo, Castrelos, Castro de Avelãs, Deilão, Donai, Espinhosela, Faílde, Formil (Gostei), Freixedelo (Grijó de Parada), Gondesende, Gostei, Macedo do Mato, Meixedo, Milhão, Mós, Oleiros (Gondesende), Paçó (Mós), Paradinha (Outeiro), Paradinha Nova, Parâmio, Pombares, Quinta das Carvas (Bragança - Santa Maria), Quintela Lampaças, Rebordainhos, Rio de Onor, Rio Frio, Sacoias (Baçal), Sanceriz (Macedo do Mato), São Julião, Sarzeda (Rebordãos), Sendas, Sortes, Vale de Nogueira (Salsas), Varge (Aveleda) e	30	0,5
Developed spaces of Type VI	Remaining built-up areas	30	0,4

According to the definitions set out in the 5th article, the land occupation index is given by the quotient between the total implantation surface ($\sum A_i$) and the land surface (A_S) the index refers to, and it is expressed as a percentage [($\sum A_i/A_S$)x100]. The land use index, by its turn, is given by the quotient between the total built area ($\sum A_c$) and the land surface (A_S) the index refers to [($\sum A_c/A_S$)].

The developing spaces that belong to the types I, II, III, IV and V within the category of land which development may be programmed – and also according to their location in built-up urban areas – are made up by the areas expected to acquire the characteristics of developed spaces, despite they don´t possess them yet. These spaces are aimed at different occupations and uses, namely housing (with garage parking places and annexes), equipment facilities and public urban green spaces, trade, services, industrial businesses of type 3, and activities compatible with the prevailing use. New buildings require approval through detailed plans, lot division operations or execution units to be erected in these spaces. To build in already existing buildings presumes the existence of paved streets, urban infrastructures and wastewater treatment plants (article 52nd). The building parameters applicable to these spaces are systematized in Table 2:

Table 2. Building regime of the developing spaces by space typology (Source: Diário da República, 2010c)

Space typologies	Built-up urban areas	Maximum occupation index (%)	Maximum use index (m^2 of built surface/m^2 of land)
Developing spaces of Type I	Bragança	60	4
Developing spaces of Type II	Bragança	60	2
Developing spaces of Type III	Izeda	40	0,8
Developing spaces of Type IV	Bragança, Gimonde, Parada, Rebordãos, São Pedro de Sarracenos e Santa Comba de Rosas	30	0,6
Developing spaces of Type V	Quinta das Carvas (Bragança - Santa Maria), Rio Frio e Sarzeda (Rebordãos)	25	0,5

The current Municipal Master Plan increased by 26.6% (1 207.8 hectares) the surface of urban land. It results from a rigorously space delimitation, from the integration within the urban perimeter of buildings originally outside it as well as neighbouring buildings erected in the meanwhile, from the creation of new industrial areas or from the expansion of the already existing ones, as well as from the delimitating borders integrated in the environmental urban structure (Nemus, 2009; Plural, 2009) (Table 3):

Table 3. Surfaces assigned to urban land uses proposed by the enforced Municipal Master Plan of Bragança (Source: Plural, 2009)

Space subcategories			Surface (ha)		%
			Partial	Total	
Developed land	Developed spaces	Type I	384,8	2184,1	57,2%
		Type II	32,1		
		Type III	49,7		
		Type IV	593		
		Type V	616,8		
		Type VI	507,7		
	Equipment spaces			156,1	4,1%
	Industrial spaces			151,4	4,0%
Land which development may be programmed	Developing spaces	Type I	2,3	382,8	10,0%
		Type II	49,4		
		Type III	12		
		Type IV	299,2		
		Type V	19,9		
	Equipment spaces			134,2	3,5%
	Industrial spaces			187,7	4,9%
Environmental urban structure				622,5	16,3%
Total urban land				3818,8	100,0%

4.2 Application of the methodology to the Municipality of Bragança

The average annual investment in urban infrastructures´ execution, maintenance and reinforcement amounted to 5 980 625 € (Table 4):

Table 4. Investments allotted to urban infrastructures´ execution, maintenance and reinforcement in the Municipality of Bragança (Source: Câmara Municipal de Bragança, 2007, 2008, 2009, 2010a)

Investments in urban infrastructures´ execution, maintenance and reinforcement	2009	2010	2011	2012
Repairs in different streets in the city of Bragança	25.000	20.000	700.000	150.000
Reconversion of urban Infrastructures in Forte de S. João de Deus area	500			
Different pavements in the city of Bragança	5.000	5.000	5.000	5.000
Reconversion of Av. João da Cruz and other streets	500	5.000	5.000	1.000
Remodelling of Av. Cidade de Zamora and Av. Do Sabor	500	5.000		
Duplication of Av. General Humberto Delgado from the school Abade de Baçal to the inside circular road	2.100.000	400.000	5.000	1.000
Construction of the west approach road to the city since the inside circular road till Av. Abade de Baçal	500	5.000	5.000	1.000
Construction of the cycle lane in the environmental area of IPB	1.600.000	1.800.000	500.000	100.000
Requalification of approach roads to different villages	25.000	5.000	5.000	5.000
Requalification of squares in villages	120.000			
Execution of lot infraestrutures in S. Tiago - 1st Phase	450.000	50.000	20.000	1.000
Repavement of residential areas in the city of Bragança	1.000.000	500.000	50.000	25.000
Different pavements in the city of Bragança	80.000	300.000	50.000	20.000
Requalification of Izeda´s central street		5.000	5.000	1.000
Construction of the cycle lane - 2nd Phase - connection to CCV		30.000	895.000	200.000
Construction of the cycle lane of Mãe d´Água		200.000	530.000	200.000
Construction of the new sqare of Mãe d´Agua		100.000	400.000	200.000
Repavement of Av. Abade de Baçal and the twentieth-century residential area				60.000
Repavement of the streets in the industrial area	500			
Construction of the inside circular road - connection to Av. Abade de Baçal				350.000
SEWERAGE	523.500	430.000	585.000	1.791.000
WATER SUPPLY	254.000	410.000	410.000	209.000
ENVIRONMENTAL PROTECTION AND CONSERVATION OF THE NATURE			130.000	
Gardening of different municipal spaces	30.000	30.000		31.000
Acquisition of equipment and urban maintenance	10.000	30.000		30.000
Protection of built-up areas	1.000	5.000		1.000
Green park of Coxa	500	20.000		
PUBLIC LIGHTING	145.000	110.000	110.000	47.500
Construction of infrastructures in the industrial area	205.000	10.000	10.000	1.000
Maintenance of the municipal road network	85.000	30.000	40.000	35.000
Different pavings	150.000	550.000	100.000	50.000
Traffic signs in the municipal road network - directional and informative signs	5.000	5.000	75.000	10.000
Urban road signs	25.000	20.000	50.000	10.000
Maintenance of the urban road network - road signs and painting	125.000	30.000	30.000	20.000
Construction of a little bridge in the CM over the Fervença River		30.000	20.000	1.000
Construction of the international bridge over the Maçãs River	55.000			
Pavement of municipal roads	1.271.000		15.000	3.000
Pavement of different villages with granit cubes	880.000		30.000	1.000
Repairs and paving of municipal roads	100.000		435.000	147.000
Repirs, widening and paving of municipal roads			366.000	40.000
Maintenance of car parks		25.000		5.000
Ground leveling and widening of the streets	150.000			
Parking	1.500			
TOTAL	9.424.000	5.165.000	5.581.000	3.752.500
Annual average investment (€)	5.980.625			

Table 5 points out the total gross built surface finished each year correspondent to urban uses, presuming the liveable area represents 65% of the gross built surface.

The average annual cost/m^2 with urban infrastructures´ execution, maintenance and reinforcement is computed as the quotient between the municipal average annual investment (expressed in euros) and the average annual gross built surface (Table 5):

Table 5. Computation of the average annual cost/m^2 with urban infrastructures´ execution, maintenance and reinforcement carried out by the Municipality of Bragança during 2008, 2009, 2010 and 2011 (Source: INE, 2009, 2010, 2011, 2012)

	2008	2009	2010	2011	Total	Annual average
Total number of finished buildinds	240	184	120	132	676	169
Floors per building (nº)	2,55	2,40	2,60	2,40	9,95	2,49
Dwellings per floor (nº)	0,64	0,80	0,80	0,70	2,94	0,74
Compartments per dwelling (nº)	5,47	5,40	4,90	5,30	21,07	5,27
Average liveable surface per compartment (m^2)	20,04	19,90	19,70	20,80	80,44	20,11
Total gross built surface (m^2) (urban uses)	66.054,6	58.405,3	37.067,5	37.610,5	199.138	49.784
Average annual investment (€)	5.980.625					
Average annual cost with infrastructures´ execution, maintenance and reinforcement (€/m^2)	84,6					

The average transaction price of land aimed at development is given, in each year, by the quotient between the total amount of traded urban properties and the total urban built gross surface. Construction costs/m^2 are, then, subtracted to the correspondent annual values, thus leading to the value/m^2 of the difference between the transaction value and the construction costs (Table 6):

Table 6. Computation of the value/m^2 of the difference between the average transaction value and the construction costs in the Municipality of Bragança, for 2008, 2009, 2010 and 2011 (Source: INE, 2009, 2010, 2011, 2012)

	2008	2009	2010	2011
Total transaction value of urban properties (€)	50.193.000	45.775.000	36.516.000	27.282.000
Total gross built surface (m^2) (urban uses)	66.054,6	58.405,3	37.067,5	37.610,5
Transaction value/gross built surface (€/m^2)	759,9	783,7	985,1	725,4
Construction costs/m^2 (€/m^2)	282,4	282,4	282,4	282,4
(Transaction value - construction costs)/m^2 (€/m^2)	477,5	501,3	702,7	443,0

According to the Municipal Master Plan, the licensed gross built surface per square meter of land for urban uses was computed for each studied year, in order to find out the land surface that corresponds to the gross built surface. So the gross surface which can be built in each kind of area assigned to developed space – within the delimited areas of developed land and land which development may be programmed – is given by the product between the maximum land occupation index (expressed in %) and its maximum land use index (expressed in m^2 of gross built surface/m^2 of land). For each of these types of land uses the difference between the value of transactions and the construction costs set in the applicable governmental decrees was then computed through the product between the gross surface that can be erected per m^2 of land and respective value/m^2 in each year (computed in table 6). This value is, then, weighted by the percentage of each type of surface (in relation to the total municipal surface assigned to urban uses), and its total sum extended to the whole types of land points out the value of land/m^2 for the corresponding year. The annual average value is given by the average between land values/m^2 for 2008, 2009, 2010 and 2011.

To this land value/m^2 is, then, subtracted the average cost of urban infrastructures´ execution, maintenance and reinforcement (previously computed). An average price of 196.8 euros/m^2 of land is, finally, arrived at (Table 7):

Table 7. Computation of the average land price/m^2 based on market transactions that occurred in the Municipality of Bragança, in 2008, 2009, 2010 and 2011

Space subcategories	Developed land						Land which development may be programmed					Average land price/m^2
	Developed spaces						Developing spaces					
	Type I	Type II	Type III	Type IV	Type V	Type VI	Type I	Type II	Type III	Type IV	Type V	
Maximum occupation index (%)	0,6	0	0,4	0,4	0,3	0,3	0,6	0,6	0,4	0,3	0,25	
Maximum use index (m^2 of built surface/m^2 of land)	4	0	0,8	0,6	0,5	0,4	4	2	0,8	0,6	0,5	
Licensed built surface/m^2 of land	2,4	0	0,32	0,24	0,15	0,12	2,4	1,2	0,32	0,18	0,125	
Surfaces assigned to each type of use (ha) (M. Master Plan)	384,8	32,1	49,7	593	616,8	507,7	2,3	49,4	12	299,2	19,9	
% of surfaces assigned to each type of use (ha) (M. Master Plan)	15,0%	1,3%	1,9%	23,1%	24,0%	19,8%	0,1%	1,9%	0,5%	11,7%	0,8%	
(Transaction value - construction costs)/m^2 of land (2008)	1.145,9	0,0	152,8	114,6	71,6	57,3	1.145,9	573,0	152,8	85,9	59,7	
Weighting of (Transaction value - construction costs)/m^2 of land for each type of land (2008)	171,8	0,0	3,0	26,5	17,2	11,3	1,0	11,0	0,7	10,0	0,5	253,0
(Transaction value - construction costs)/m^2 of land (2009)	1.203,2	0,0	160,4	120,3	75,2	60,2	1.203,2	601,6	160,4	90,2	62,7	
Weighting of (Transaction value - construction costs)/m^2 of land for each type of land (2009)	180,4	0,0	3,1	27,8	18,1	11,9	1,1	11,6	0,7	10,5	0,5	265,7
(Transaction value - construction costs)/m^2 of land (2010)	1.686,5	0,0	224,9	168,7	105,4	84,3	1.686,5	843,3	224,9	126,5	87,8	
Weighting of (Transaction value - construction costs)/m^2 of land for each type of land (2010)	252,8	0,0	4,4	39,0	25,3	16,7	1,5	16,2	1,1	14,7	0,7	372,4
(Transaction value - construction costs)/m^2 of land (2011)	1.063,2	0,0	141,8	106,3	66,4	53,2	1.063,2	531,6	141,8	79,7	55,4	
Weighting of (Transaction value - construction costs)/m^2 of land for each type of land (2011)	159,4	0,0	2,7	24,6	16,0	10,5	1,0	10,2	0,7	9,3	0,4	234,7

In order to compute the price/m^2 of municipal land (urban developed land and land which development may be programmed) in the Municipality of Bragança, based on the application of the Real Estate Municipal Tax Code, for each type of land use identified in the Municipal Master Plan, a minimum and a maximum limit for the tributary patrimonial value/m^2 was computed (through the application of the article 38th). The minimum value (expressed in €/m^2) is obtained through the product between the base value of the buildings, and the coefficient of surface adjustment, the minimum coefficients of allotment, location and quality and comfort, and the ancientness coefficient referring to former works. The maximum value (expressed in €/m^2) is obtained through the product between the base value of the buildings, and the coefficient of surface adjustment, the maximum coefficients of allotment, location and quality and comfort, and the ancientness coefficient referring to recent works. The arithmetic average between the minimum and maximum tributary patrimonial values per square meter of land leads to the average tributary patrimonial value/m^2 (€/m^2). As these average values refer jointly to land and buildings it is necessary, thereafter, to subtract the building costs and the average annual costs with infrastructures´ execution, maintenance and reinforcement (already computed) (Table 8):

Table 8. Computation of the average value of land/m^2 allotted to developed and developing spaces in the Municipality of Bragança, based on the application of the Real Estate Municipal Tax Code

Space subcategories	Developed land and land which development may be programmed
	Developed/developing spaces
Vc = Base value of the buildings (€/m^2)	603
Coefficient of surface adjustment	0,85
Minimum coefficient of allotment	0,8
Maximum coefficient of allotment	0,7
Minimum coefficient of location	0,35
Maximum coefficient of location	1,3
Minimum coefficient of quality and comfort	0,5
Maxumum coefficient of quality and comfort	1,7
Coefficient of ancientness (recent works)	1
Coefficient of ancientness (former works)	0,4
Minimum tributary patrimonial value (€/m^2)	28,7
Maximum tributary patrimonial value (€/m^2)	792,9
Average tributary patrimonial value (€/m^2)	410,8
Infrastructures´ costs/m^2 of land (€/m^2)	84,6
Construction costs/m^2 of land (€/m^2)	282,4
Municipal average land value, according to the Real Estate Tax Municipal Code (€/m^2)	43,8

The municipal average value of land in spaces aimed at urban development is, thus, of 43.8 €/m^2, according to the Real Estate Municipal Tax Code.

5 Conclusions and recommendations

The values obtained from the application of the Real Estate Municipal Tax Code (43.8 €/m^2) are substantially lower than the average value of market transactions (196.8 €/m^2). This emphasizes the potential of the current objective and benchmarked land assessment methodology to support urban planning and management decisions that concern, namely, development processes, the implementation of accessibilities, and the subsequent overall promotion of mobility for the whole population in general, and exerts important impacts in order to decrease the costs of infrastructures and of other public works that could be possibly implemented.

The systematization, within the framework of a legal platform – based on the Real Estate Municipal Tax Code, and applied in the scope of the new Land Use Law – of the current methodology for land price assessment prevents land speculation and, thereafter, warrants more fair real estate prices, promotes the restoration of ancient vacant buildings and the development of interstitial urban areas. This enables a better control over urban sprawl, fosters the optimization in the use of resources and urban infrastructures, fights against urban corruption, thus allocating for citizens in general land appreciation that accrue from planning decisions and from municipal urban interventions.

Among some possible management measures that may support the implementation of the strategy sketched in the Municipal Master Plan of Bragança that fit the intervention guidelines concerning mobility and accessibility, that may benefit from the current setting of parameters on land values and respective control proposed in this research, it is important to highlight (Nemus, 2009; Plural, 2009): the transformation of the municipal aerodrome into a regional airport; the establishment of the railway connection between Bragança and Puebla de Sanabria (with connection with the high speed rail network, thus favouring mobility integration between the proposed regional airport, the

rail network, and the Trás-os-Montes highway); the incentive to increment the use of the public transports system; and the implementation of a network of cycle lanes (according to local Agenda 21).

This research – that assesses land values according to criteria based on its real and actual values (and not speculative ones) – is expected to contribute to the socioeconomic sustainability of the general urban development and, in particular, to the promotion of a smart mobility, extensible to different municipalities, within different contexts and development processes.

Endnotes

[1] The latter data provided by the Portuguese National Statistics Institute concerns the year of 2011. So in order to compute the average annual value for a four-year term the gross built surfaces were estimated for 2008, 2009, 2010 and 2011.

[2] Namely the Sectorial Plan of Natura Network 2000, Plan of Douro´s hydrological basin, Regional Plan for north-eastern Forest Ordinance, and the Ordinance Plan of the Natural Park of Montesinho.

References

Arnott R, Petrova P (2006) "The property tax as a tax on value: deadweight loss" *International Tax and Public Finance* **13**(2) 241-266

Câmara Municipal de Bragança (2007) *Plano Plurianual de Investimentos 2008*, www.cm-braganca.pt

Câmara Municipal de Bragança (2008) *Plano Plurianual de Investimentos 2009*, www.cm-braganca.pt

Câmara Municipal de Bragança (2009) *Plano Plurianual de Investimentos 2010*, www.cm-braganca.pt

Câmara Municipal de Bragança (2010a) *Plano Plurianual de Investimentos 2011*, www.cm-braganca.pt

Câmara Municipal de Bragança (2010b) *Regulamento do Plano Director Municipal de Bragança* (2010b), www.cm-braganca.pt

Diário da República (2008), *Portaria nº 1545/2008, de 31 de Dezembro*

Diário da República (2009), *Portaria nº 1456/2009, de 30 de Dezembro*

Diário da República (2010a), *Portaria nº 1330/2010, de 31 de Dezembro*

Diário da República (2010b), *Portaria nº 466/2010, de 6 de Julho*

Diário de República (2010c), *Aviso nº 12248-A/2010, de 18 de Junho (Aprovação Final do Plano Director Municipal de Bragança)*

Diário da República (2011), *Portaria nº 307/2011, de 21 de Dezembro*

Instituto Nacional de Estatística, I. P. (2012) *Anuário Estatístico da Região Norte 2011*, Lisboa. Portugal, www.ine.pt

Instituto Nacional de Estatística, I. P. (2011) *Anuário Estatístico da Região Norte 2010*, Lisboa. Portugal, www.ine.pt

Instituto Nacional de Estatística, I. P. (2010) *Anuário Estatístico da Região Norte 2009*, Lisboa. Portugal, www.ine.pt

Instituto Nacional de Estatística, I. P. (2009) *Anuário Estatístico da Região Norte 2008*, Lisboa. Portugal, www.ine.pt

Instituto Nacional de Estatística, I. P. (2009-2012) Censos 2011 XV recenseamento geral da população, V recenseamento geral da habitação, Lisboa, Portugal, www.ine.pt

Lee K (2003) "Should land and capital be taxed at a uniform rate?" Canadian Journal of Economics **36**(2) 350-372

Nemus, Gestão e Requalificação Ambiental, Lda. (2009) *Avaliação Ambiental da 1ª Revisão do Plano Director Municipal de Bragança,* Volume I – Resumo Não Técnico, Câmara Municipal de Bragança, Bragança, Portugal

Pardal S (2004) "A fiscalidade e o ordenamento do território", Faculdade de Direito de Lisboa, Lisboa (15th to 19th November)

Pardal S (2006) *A apropriação do território. Crítica aos diplomas da RAN e da REN*, Ingenium Edições, Lda., Ordem dos Engenheiros, Lisboa, Portugal.

www.wikipedia.org

Plural (2009) *1ª Revisão do Plano Director Municipal de Bragança – Relatório*. Volume II. Janeiro de 2009. Câmara Municipal de Bragança, Bragança.